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SPACE AT THE SERVICE OF OUR ENVIRONMENT

SURFACE PROCESSES IN GREENLAND SEA CONVECTION

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This research project addresses mean convection in the Greenland Sea, one of *on] y* 4 places **in the** world ocean in which this process occurs. Convect ion is the process by which surface waters are taken to the intermediate or deep ocean, forming the surface terminus of a circulation system which exercises considerable influence over the climate. Convection constitutes a negative feedback for the radiation-climate interaction; sut-face cooling can bring warm water up to the surface in opposition to the usual picture in which surface, cooling results in ice. formation which reduces insolation and further cools the air-sea system. Finally, convection in the Greenland Sea requires the presence of a fresher surface layer originating in the summer meltwater of the East Greenland Current. "J'bus, this convection can be shut down fully in one year, significant since the discovery in ice sheet cores that important climate changes have occurred over only 3-year intervals.

Satellites arc essential for this study. The convecting regions of the ocean occupy less than 1 % of its area while 3/4 of the. oceanic volume moves through them during the renewal cycle. Convecting plumes are probably only a few hundred meters across, the convecting regions may be as small as 10 km, and the life spans of these features are measured in mere clays. In two polar Seas, the Weddell and the Greenland Seas, ice growth is the brim source to bring the surface waters to the salinity of the deep waters. An additional aspect of convection is thus seen to be the logistical difficulties imposed by the ice. These logistical difficulties, the plume time and space scales, and the capability of satellite systems in ice monitoring all suggest use of satellite data.

in this program SSM/I data have been used to characterize the regional behavior of Greenland Sea ice and ERS- 1 SAR data have been used to help specify physical processes on the surface. Comparing the SSM/I data for] 989 with ocean mooring data indicated that the well known retreat (called Nordbukta) in the Greenland Gyre ice prot uberance (called Odden) was the consequence of convection (Aagaard, K,, A. Roach and F. Carsey, *Atmosphere-Ocean*, 1993, in press). "l'his convection was seen to propagate both (or either) down wind and up the surface salinity gradient, and a number of questions were raised as to the initiation and evolution of the convection. An examination of the ice edge structure, showed that ice typically forms when there is still oceanic sensible heat available.; thus, the heat lost through the ice cover is greater than the heat advected away as ice, and this balance is important as the ice growth part relates directly to the brine generat ion. Using ERS- 1 SAR data we have been able to ident ify ice edge features that arc very similar to modeled plumes and to tentatively confirm that the northern Odden ice is pancake in form, The plume observation is the first such identification, and is very exciting; it has further helped to clarify the likely processes working in the convecting watt.r. The plumes that we think we see have a very interesting property: they arc topped by ice; ice is thus not only at work in the initiation of convect ion but in its maintenance, as well. Ice will only form and grow on the. freshened top layer of the sea, and our hypothesis that icc drives the convection emphasizes the importance of this fresher layer. This project cent inues to produce. interest ing and useful results and 10 point to future work.

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